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APPROXIMATION AND RESEARCH

AFTER THE

CHOLERAIC PRINCIPLE,

AND THE MEANS TO RENDER

PRESENTED
by the
AUTHOR.

THE CAUSES INNOCUOUS.

With the Author's Comments

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THE CHOLERAIC PRINCIPLE.

THE following are a few hints, founded on unmistakeable facts, respecting the disease now again located amongst us, throwing out suggestions for an easy remedy ; and if they are good for anything, the Medical profession can easily apply their principles to advantage.

It is said by some that the cause of Cholera has to be sought for in atmospherical influences, Why should it not rather be said, that it is in gaseous compounds ? for the nature and properties of the atmosphere being known, it is not difficult to find out such an action amongst them as would of itself produce effects as direful as the disease called Cholera ; nay, even under certain circumstances, that very disease itself. For instance :—By the abstraction of oxygen from the atmosphere, or the presence of an undue proportion of nitrogen, it would follow, as a matter of course, that new combinations of gaseous bodies with the nitrogen would be made, which would act on substantive matter in a peculiar manner. Suppose, therefore, that nitrogen were unduly present in the atmosphere, this, uniting with carbon, which is ever found in the air in one form or another, whether as carbonic acid gas, or in compounds of hydrogen and carbon, would form cyanogen,* or prussic acid, under certain circumstances.

Now the Cholera bears out such an hypothesis as this, for its action is precisely what cyanogen, or prussic acid, would be on the human frame.† In proof of this, let us enquire whether the localities and cir-

* Nitrogen, 1 eq , carbon, 2 eq., make cyanogen.

† By a very gentle heat, prussic acid may be evolved in vapour. Inhalations of prussic acid up the nostrils produce sickness. Its specific gravity is little lighter than air, being, .9476. Ure says it is impossible to doubt that hydrogen enters into the composition of prussic acid. Prussic acid, when compared with other animal products, is distinguished by the great quantity of nitrogen it contains, by the small quantity of hydrogen found in it, and especially by the total absence of all oxygen.

2 primes Carbon	} Prussic acid.
1 do. Hydrogen	
1 do. Nitrogen	

cumstances affected by the Cholera bear out the conclusion, by showing that such gases are present there which would make these poisonous compounds; or do other localities, where the disease has not been known, tend to confirm the opposite conclusion, namely, that such poisonous gases are not found there? and if so, we have certainly a clue to a proper knowledge of this pest, both in a positive and negative sense. Thus, then, we do know that whenever oxygen is largely abstracted from the atmosphere, the nitrogen must be set free (for the atmosphere is but a mechanical mixture of gases), and the nitrogen would then unite with some other bodies or gases.

The abstraction of oxygen from the atmosphere is brought about where large quantities of coals are consumed, or where a large quantity of vegetable or other matter is fermenting and using up the oxygen of the atmosphere, by forming carbonic acid gas in this process of fermentation.*

* Formerly the Cholera was chiefly confined to India, where large quantities of vegetable matter are in a state of decomposition, but it is now spread over the greater part of the world. It may be safely assumed, that this is principally attributable to the great and increasing consumption of coal, for steam and other purposes. Every ton of coal consumed requires 2 tons of oxygen from the atmosphere; and every foot of atmospheric air has only 2 grains of oxygen in it. 7000 grains make 1 lb, so that 3500 feet of atmospheric air make only 1 lb. of oxygen, but twice this quantity of oxygen is required for 1 lb. of coal, therefore 7000 feet of atmospheric air are required for the consumption of 1 lb. of coal. By using coal, we are therefore depriving the air of its vitality; and when it is considered that some millions of tons of coal are annually furnished by our own country alone, it would almost seem that the whole of the oxygen in the air is not more than sufficient for the demands made upon it by the burning of coal, and that all animal life must be sacrificed, were the vast quantity of coal to be consumed at one time. There are about 4 millions of tons of coal annually consumed in this island alone; the astounding fact that they must use or require, in being burned, 8 millions of tons of oxygen, must strike us with awe, when duly considered. What must be the bulk of the atmospheric air that is deprived of its oxygen for a time, when we know (as has been previously stated,) that 1 foot of atmospheric air contains only 2 grains of oxygen, and for our annual consumption of coal, no less an amount than 303,600,000,000, that is, three hundred and three thousand six hundred millions of cubic feet of atmospheric air are required? Can this be so consumed without making a decided change in the atmosphere, in the very nature of our being and our health? The amount thus consumed is almost inconceivable; and, be it remembered, the carbonic acid gas it makes is half as heavy again as the air, and therefore rolls upon the surface of the earth until it is resolved again into carbon and oxygen. It is this fact of its rolling over the earth's surface, that causes it to meet with the hydrogenous gases exhaled from the earth. Such a stream of gas, when added to the gases disengaged from vegetable matter in the autumn, would stretch itself across the habitable globe, whence the universality of cholera; and although this quantity of carbonic acid is not generated all at one time, yet it is sufficiently so to produce cholera, and other attending evils.

Now the abundance of carbon in coal having united with so large a portion of oxygen by combustion, &c., the carbon can chemically unite, in certain electric conditions, with the nitrogen left floating in the atmosphere, and form cyanogen and prussic acid,* or some continuous compounds. Secondly, let us ask, are the effects of cyanogen, or prussic acid, upon the human frame, similar to those of Cholera? Both of them cause the blood vessels to assume a deep blue color, and produce the same action and viscosity of the blood.† Now may not the human body be acted upon by the nitrogen, &c., through the lungs, so that the blood is presented with nitrogen, carbonic acid, and hydrogenous gas, instead of its natural proportions of nitrogen and oxygen, and prussic acid is thus probably formed in the human body, and is not Cholera thus produced? So it would appear, that from the want of oxygen, or the excess of nitrogen, which is the same thing, Cholera is the result; because the air becomes capable of forming prussic acid with hydrogen in the human body, or, otherwise, it is inhaled as a vapour, and therefore Cholera is the effect, and cyanogen the radical cause. Now if we find that there are places, under certain circumstances, which produce those premises we have stated as the causes of Cholera, and where it has made its appearance, and that there are other places, under different or altogether wanting such circumstances, and where Cholera has not appeared, it may be presumed that we have discovered the true solution of its origin, and this, with the electric or physical circumstances, may aid the develop-

* Cyanogen, or a combination of nitrogen and carbon, being thus formed in the atmosphere, the origin of an attack of Cholera in the vicinity of sewers and cesspools is apparent, for there the cyanogen finds the hydrogen escaping, unites with it, producing *the vapour of prussic acid*, and deals death to all exposed to its pestiferous influence. It is to be remarked, that where there is the greatest evolution of hydrogenous gases, there the Cholera is most virulent, either in mining countries, swamps, or in the vicinity of cesspools, sewers, &c.

† The nitrogen, as one basis of the poison we are describing, which is left in the air after the abstraction of the oxygen by the combustion of this quantity of coal, amounts to four times the bulk of the oxygen extracted, or to 1,214,400,000,000 or upwards of one million of millions of cubic feet. This would alone equal a cube or square block of forty-five thousand millions of yards, and no calculation is here made of the coals procured and consumed in other places, but is simply confined to the consumption in these islands only.

ment of Cholera, because perhaps they add their aid to consummate its maturity.* Such being the case, we have then the following facts in support of our views. It is a fact, apparent in Cholera, that the veins become blue, and such is the action of prussic acid when applied to the human blood. It is a fact, that wherever Cholera rages, those parts most elevated from the earth have the fewest attacks. In Glasgow, for instance, the houses are generally very lofty, but it was noticed that in the highest stories or flats of these houses, their inmates escaped an attack, whilst in the lower stories Cholera prevailed, and was often fatal, and this occurred in the same building. Now the cause was evident, for a purer air, one having more oxygen in it, would be found in the upper stories, and doubtless one of the constituents of the disease, hydrogenous gases, were located in the lower stories, which did not reach the elevation of the upper stories until it was diluted to such an extent as to be innocuous.

It is a fact that not any, or very few, cases of Cholera occurred in Birmingham. What was the cause of this? Simply that a great abundance of oxygen is liberated or produced in that town, which keeps the atmospheric air duly proportioned with oxygen and nitrogen. The standard of the atmospheric air is four-fifths nitrogen and one-fifth oxygen, and this is a mechanical mixture. The question may be asked how we account for this singular phenomenon in Birmingham? The answer is, that an immense volume of oxygen is liberated daily there by the large quantity of nitric acid dissipated in manufacturing purposes, and also in making nitric acid. The nitric acid used there is forty parts of pure oxygen in a liquid state, and only fourteen parts nitrogen.

The whole of this oxygen is nearly all dissipated in the air when used in manufacturing purposes, making an immense volume of oxygen, and producing such a bulk or volume of oxygen gas as would be of itself capable of meeting and neutralising any overplus nitrogen

* Cholera generally rages when vegetation has arrived at its full maturity, and when the chemical action caused by its decay begins to appear, or when such electrical phenomenon occurs as gives power to the freer expression or exhibition of gases combined with hydrogen.

that might be in the atmosphere, and thus producing the natural equilibrium.*

As an opposite case, it is a fact, that in the former visitations, Cholera raged furiously at Bilston, in Staffordshire, a town near to Birmingham, but here not any nitric acid was either made or used, but other gases were generated largely at Bilston, the very reverse of those made at Birmingham, inasmuch as at Bilston an immense quantity of carbonic acid gas is made by the great consumption of coals in making coke and iron, thus absorbing the oxygen from the atmosphere; beside which, carburetted hydrogen also exudes in large quantities from the coal mines, so that at Bilston there was an over-supply of the carbon gases, and a deficiency of oxygen, and also large quantities of nitrogen and hydrogen by which the vapour of prussic acid could be generated. Does not this prove that wherever there is a store of nitrogen, carbon, and hydrogen, the human frame receives the attacks of Cholera? Is not this certain, and does it admit of a doubt?

Similar facts have occurred in other iron and coal districts, at Salcoats and Garstead, in Scotland, where the Cholera prevailed as virulently as at Bilston, and doubtless from the same causes. Therefore it may fairly be assumed that carbon has something to do with Cholera.

It is a fact also, that where oxygen abounded health also abounded, and no Cholera was found; therefore nitrogen has something to do with Cholera, and nitrogen and carbon make cyanogen, which has the same poisonous effect on the human frame when it meets with hydrogen, as the Cholera. It is not needful that a large quantity of cyanogen, or prussic acid, should be formed in our sewers to produce Cholera, but only that the ingredients to form this certain compound should be

* One hundred cubic inches of oxygen weigh 34½ grains, therefore 54lbs. of nitric acid would make 7000 grains $\times 40 =$ grains $\frac{280,000}{34}$ cubic inches in hundreds; and 8300×100 of oxygen being multiplied by 4 would neutralise a volume of air equal to 3,320,000 cubic inches, provided there was no oxygen whatever present in the air; but this volume of oxygen has merely to make up the quantity of oxygen wanting, therefore its power and influence must be immense, at the same time only 54 lbs. of nitric acid is set down as being used there daily, whereas many hundreds weight are wrought up, perhaps tons weight.

present under a certain physical action,* for a very small portion of the vapour of prussic acid received through the sewers by the human body would be sufficient to produce death.

Again, it is a fact, that in high and isolated situations where the air is pure, and in towns, that by their position are naturally drained from hydrogenous matters, that Cholera does not occur. Thus the town of Lanark, in Scotland, which stands upon a hill or elevation and drains itself, had not one single case of Cholera; and many other instances might be named of the like nature, for instance, Blackheath, near London, was partially free.

It is a fact, that in India, the Cholera attacks those places where an immense amount of vegetable and animal matter lie together and ferment, which generates carbonic acid gas, destroying the oxygen, and producing compounds with hydrogenous gas. So it is also in London and its neighbourhood and elsewhere, where cesspools, stagnant waters, and open and foul sewers, are to be found, giving out hydrogenous gases; and according to the amount let loose by these impure sources, so will be the virulence of the disease in such locality.†

Oxygen is, therefore, the prime antidote for Cholera, as an elemental matter; it may be supplied to the atmosphere in foul places, as it is applied at Birmingham, by the evaporation of nitric and other acids possessing much oxygen—thus by even leaving a small phial of nitric acid unworked in an infected house, the house would be comparatively freed from infection; or if a small portion, say a drachm or

* If the tongue of a dog be punctured with a needle dipped in prussic acid, death immediately ensues, the least tendency or power to generate cyanogen in the human body must be the cause of death to it; we have seen some cases of cholera terminate very suddenly, doubtless from the strength and quantity of the poison taken in or made.

† The reason why Cholera has prevailed so extensively in the more elevated situations in the Metropolis, at the present time, is this: those parts and streets lying high, *are now connected with the lower parts of the town*, by the new sewers, the consequence is, that the higher parts have become *funnels or chimneys* to draw up the hydrogenous gases out of the lower parts or levels, and thus we must expect, in future, the higher places will have the baneful gases in the greatest abundance, and will suffer by the severest visitations, unless such proper precautions are taken in constructing and contriving the sewers as will prevent this physical fact from becoming fatal to health and life. The plan to accomplish this salutary alteration is easy, and would obviate all danger from the like occurrence in future, and prevent these higher situations of the town from becoming the pest houses of this great city.

two, of nitric acid were poured upon a hot brick placed in the lowest room of a house, this would most likely be found an antidote against infection: in this latter case, every door connecting one room with another should be opened, and the outer house door and all the windows kept closed, so as to permit the gas to have free circulation. Or take one ounce of nitric acid and five gallons of water and wash the kitchen floors, yards, &c. frequently with this diluted liquid when the contagion is apprehended. This mixture might be used beneficially also for the common sewers, sinks, &c.

Another remedy is equally efficacious and necessary, namely, to decompose the feculent matter of cesspools and other receptacles of filth, which we have taken occasion to point out elsewhere, and wherever stagnant waters in gutters, butts, &c. are found, chloride of lime should be used to destroy the hydrogenous poison.*

Now it is worthy of consideration whether oxygen could not and should not be administered, with other things, in some form or other. When a patient is suffering under an attack of Cholera, would not dilute nitric acid be an antidote, if properly administered; for to administer oxygen does not present any difficulty when properly taken in hand?† Now, therefore, assuming it to be more than probable that Cholera is taken into the body by inhalation, and that the overabundance of nitrogen in the atmosphere at certain places, meeting with the carbon, and also mixing with hydrogenous gases exhaled from the sewers, cesspools, &c., is not the principle of cyanogen, or prussic acid, thus formed, carried by the blood through the whole body? and

* Nitric acid might be used in an infected neighbourhood, by evaporating it, on the windward side of a district, so directing its course, that the fumes might spread over the entire space. Thus a district or single house might be rendered habitable by bringing the atmosphere into a healthy state, although this might not preclude the return of the disease, if cleanliness were not attended to and enforced, and those causes removed or neutralised by disinfectants which produce the hydrogenous gas compounds.

† Why cannot oxygen be given in large proportions through the medium of mineral agents? We would suggest pills made of the white peroxide of manganese, (prepared as stated in Thenard's Work on Chemistry, vol. ii., p. 333, à Paris chez Crochard,) for it is known that manganese parts with its oxygen most easily, oxygen would thus be carried into the system. It is evident that oxygen is not proper to administer to the lungs, *per se*, but would not oxygen carried thus through the system, supply the blood with its life giving principle, so as to destroy the deleterious tendency of nitrogeous compounds with which the choleraic poison had imbued it?

does not this shew, as a consequence, that oxygen is wanting, and therefore that it will be the antidote for the choleraic principle? It is true, that chlorine gas is the destroying element to eradicate that death-dealing compound—the hydrogenous gases; but the mischief is done when the body has taken in the disease, and as chlorine cannot be given effectively, perhaps, to the patient, oxygen might be administered.

Oxygen enters into an immense number of articles* in our *Materia Medica*, which may be administered with effect, but even to impart it to the lungs is not dangerous if air strongly impregnated with oxygen is supplied to the chamber of the patient. The effect of oxygen on the human lungs is almost magical, no animal can live without it. To rob the lungs of their proper proportion of oxygen is to destroy life. When too much carbon is presented to the lungs, either by drinking ardent spirits, or otherwise, the lungs are prepared for the action of nitrogen and hydrogen, or for the action of choleraic poison. This is frequently evidenced in the case of persons who indulge privately or publicly in the excessive use of alcoholic drinks, with whom the Cholera makes short work in its attack.

It would appear then, that the only mode of getting rid of the Cholera is to extirpate every nuisance, or matter, that generates hydrogenous compounds. Probably the compounds of cyanogen might pass over a neighbourhood where there were no such nuisances as the above emanations from sewers, &c., without producing any mischief; whilst, on the other hand, in its course it will attack, with fatal effect, those places where alone hydrogenous gases abound. This proves the extreme necessity of sanitary provisions compelling the carrying away

* The following is a small list of vegetable substances which contain oxygen in the greatest proportions, and which may be tried as preventives. Has their action been proved?—

	c.	h.	o.
Oil of Cinnamon	20	11	2
Cinnamic acid	60	33	14
Oil of Nutmeg and Mace	8	16	3
Oil of Anise	20	12	2
Oil of Peppermint	20	20	2
Menthene and nit. acid	10	9	9*
Oil of Marjoram	14	14	5
Nitrate of Potash	0	0	0

* Particularly recommends itself; it is produced by the action of nitric acid on menthene.

and removing of all dirt, filth, ordure, and every other nuisance in every district. Government should enforce this by the most stringent laws and regulations, and aid public and private exertions in that direction. It is also as imperative a duty for every individual in society to aid, with his best exertions, and to the extent of his ability, in keeping his house and premises free from impurities, even as much so as he does with regard to his own personal cleanliness ; and until these things be thoroughly and universally attended to, the scourge under which we now suffer, will, with more or less violence, be our constantly recurring visitor.

In conclusion, we must recur to the fact, that the use of coals, in such abundance as used at this present time, is attended with effects which require our serious attention, or the advantages which it has helped us to attain, will not prove to be an unqualified blessing ; it behoves us to reflect that every benefit bestowed, creates a new duty to be performed.

Let our object, therefore, be to remove and destroy all emanations of hydrogenous gases, rendering them innocuous by a system of decomposition in their nestling places ; which is no difficult task, if rightly attended to, inasmuch as Nature in her bountiful store has provided us with ample materials for this purpose, and they are within our reach at all times. Thus it is certain that every sewer and cess-pool may be rendered perfectly harmless ; their construction requiring but little preparation to fit them for this use of decomposing pestilential compounds. In offering these few remarks and suggestions to public notice, I have been actuated solely by a desire to point out the way to mitigate an evil and effect a good ; and should I have succeeded in this, only in a small degree, I am more than compensated for the trouble it has occasioned, and will, at all times, devote my best endeavours, with my fellow men, to eradicate this pest, if possible.

P.S.—Some test of the correctness of the principles laid down in the above Essay, has occurred since the above has been sent to press. The subsiding of Cholera has been announced in Official quarters, which has doubtless taken place in consequence of the equinoctial

gales having made a disturbance in the atmosphere, and having intermingled, or driven off, the pestilential gases, so as to destroy their concentrated energies, by this interruption of their former settled state.